INTERLABORATORY PROGRAMS FOR RUBBER

ANALYSES NO. ~~36~~ 37

~~APRIL~~ - JUNE ~~1978~~ (SteT)

July - Sept. 1978

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

NBS COLLABORATIVE REFERENCE PROGRAMS

TAPPI Paper and Board (6 times per year)

- Bursting strength
- Tearing strength
- Tensile breaking strength
- Elongation to break
- Tensile energy absorption
- Folding endurance
- Stiffness
- Air resistance
- Grammage
- Smoothness
- Surface pick strength
- K & N ink absorption
- pH
- Opacity
- Blue reflectance (brightness)
- Specular gloss, 75°
- Thickness
- Concora (flat crush)
- Ring crush

FKBG-API Containerboard (48 times per year)

- Mullen burst of linerboard
- Concora test of medium

MCCA Color and Appearance (4 times per year)

- Gloss at 60°
- Color and color difference
- Retroreflectivity

Rubber (4 times per year)

- Tensile strength, ultimate elongation and tensile stress
- Hardness
- Mooney viscosity
- Vulcanization properties

ASTM Textiles (3 times per year)

- Flammability (FF3-71 and FF5-74)

ASTM Cement (2 times per year)

- Chemical (11 chemical components)
- Physical (8 characteristics)

AASHTO Bituminous

- Asphalt cement (2 times per year)
- Cutbacks (once a year)

Collaborative Reference Programs
B360 Polymer Building
National Bureau of Standards
Washington, D.C. 20234

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INTERLABORATORY PROGRAMS FOR RUBBER

Analyses No. 37
July - September 1978

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U. S. DEPARTMENT OF COMMERCE
National Bureau of Standards

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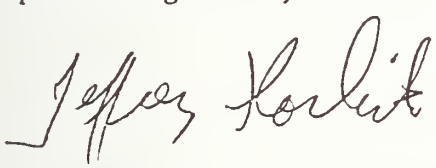
INTRODUCTION

This report summarizes the test results for the second quarter of 1978. The tests cover the four areas in the NBS Collaborative Reference Programs for Rubber: Tensile Properties, Hardness, Mooney Viscosity, and Vulcanization Properties.

For each of the four areas, there is a set of summary tables followed by a table of data and analysis by laboratory and a graphical presentation of the data and analysis. Where applicable, the tables of data have the English and Metric expressions side-by-side. Additional details are given in the section "Key to Tables and Graphs."

If there are questions or comments on the notes, the analyses, or the reports in general, contact Jeffrey Horlick (301) 921-2946.



Jeffrey Horlick, Administrator
NBS Collaborative Reference Programs
Office of Testing Laboratory Evaluation Technology

May 24, 1979

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KEY TO TABLES AND GRAPHS

LAB CODE — Confidential laboratory identification number known only to the participant and the Collaborative Reference Program staff.

F — A flag identifying results that are extreme in comparison with the other results.

- X - The plotted point for the indicated laboratory lies outside of the 99% error ellipse (not shown); ie, assuming normal distribution, 99% of laboratories similar to those participating in the program will be represented by points lying within the 99% ellipse.
- * - The plotted point for the indicated laboratory lies outside of the 95% error ellipse shown on graphs, but inside the 99% ellipse.

MEAN — The arithmetic average of the two median values for the two sheets or samples of the same material.

% DEV — The deviation or difference of the laboratory MEAN from the GR. MEAN (see below), expressed as a percent of the GR. MEAN.

REL SDR — The ratio of the SDR (standard deviation of replicate measurements within a laboratory) to the AVER SDR (see below). Extreme values, ie, values that are likely to occur by chance less than one time in a hundred as determined by the chi-square test, are marked with an "X".

VAR CODE — A code number designating a particular test instrument, set of environmental conditons, procedure, unit used, or other variation. The code "01" designates the instrument, conditions and procedure specified at the top of the page either explicitly or in the cited ASTM Standard, and the unit of test shown at the top of the first column of data. A '+' in front of the VAR CODE indicates that the data has been excluded from the grand means due to a non-standard variation of the possibilities mentioned above, or the data is extreme.

GR MEAN — The arithmetic average (grand mean) of all the laboratory MEAN values, excluding those flagged (F) with an "X".

SD MEANS — The standard deviation among the laboratory MEAN values included in the GR. MEAN.

AVER SDR The arithmetic average of all the standard deviations of within laboratory replication, excluding those excluded from the GR. MEAN and excluding any additional ones for which the REL SDR has been flagged.

GRAPH

For each laboratory the MEAN for the second material is plotted against the MEAN for the first material, with each point representing a laboratory. The horizontal and vertical lines are the GR. MEAN values. The dashed line is drawn at 45°. The solid sloping line, which may or may not lie close to the 45° line, is the major axis of the ellipse. The ellipse is drawn so that, on the average, it will include 95% of the points representing the laboratories. The plotted symbols X and * used to represent results falling outside the ellipse are explained under "F" above. Laboratories inside the ellipse (no flag in the F column) are plotted as an O.

The graph is plotted with an ellipse when there are 20 or more laboratories in the analysis. When there are 10 through 19 laboratories in the analysis, the graph is plotted but the ellipse is omitted. When there are fewer than 10 laboratories retained in the Grand Mean the graph is not plotted.

For development of the theory, see the paper by J. Mandel and T.W. Lashof, Interpretation and Generalization of Youden's Two-Sample Diagram, J. of Quality Technology, Vol. 6, pp 22-36, Jan. 1974.

SUMMARY OF ANALYSES

LABS INCL Number of laboratories included in the GR. MEANs.

LABS OMIT Number of laboratories reporting data but excluded from the GR. MEANs.

STANDARD DEVIATIONS

LABS Same as the SD MEANs (see above)

SHEETS Standard deviation between the two sheets or samples of the same material.

REPL Same as AVER SDR (see above)

PRECISION OF METHODS

REPL CRP The number of replicate measurements per sheet or sample, as specified in the Collaborative Reference Program.

REPL ASTM The number of replicate measurements specified for a test result in the designated ASTM Standard.

REPEAT — The repeatability, a measure of the within laboratory precision, i.e., of the ability of the test technician to repeat his test result: two test results obtained by the same technician on the same homogeneous sample of material may be expected 95% of the time to agree within the repeatability.

REPROD — The reproducibility, a measure of the between laboratory precision: two test results obtained in different laboratories may be expected 95% of the time to agree within the reproducibility.

ABSOLUTE — Values of REPEAT and REPROD expressed in the units of measurement.

PERCENT — Values of REPEAT and REPROD expressed as a percent of the GR. MEANs.

TENSILE STRENGTH, ULTIMATE ELONGATION, AND STRESS AT 300% ELONGATION

NOTES

Material C81 and C82 were sheets of the same vulcanized rubber. Similarly, materials C83 and C84 were alike.

V100 results were obtained at NBS using a pendulum tester.

All participants used Die C in ASTM D412 with the following exceptions:

V0070 used ASTM Die B
V0122, V0178 and V0208 did not specify a Die
V0126 used Die 2 in BS903
V0213 and V0225 used ASTM Die D

Electronic testers were used by 44 (66%) of the 67 participants; pendulum testers were used by 20 participants; 3 participants did not specify either type. Elongation measurements were made by automatic devices by 24 (36%) participants and manually by the rest. There were 24 (36%) reported relative humidities above 55% and 14 (21%) reported relative humidities below 45%. Seven participants (10%) did not report the relative humidity used.

SUMMARY OF ANALYSES

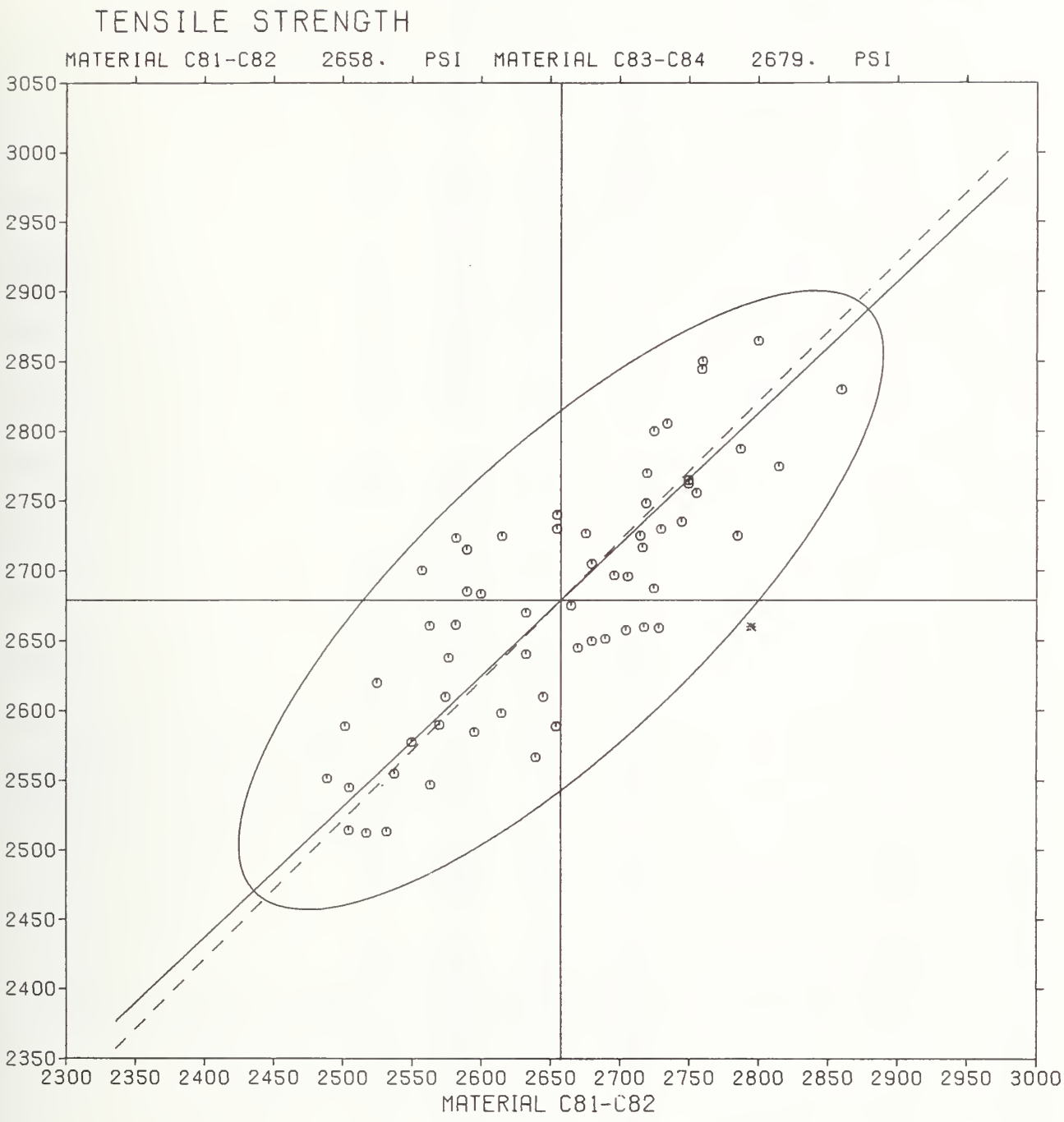
PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR. MEAN	STD DEVIATIONS LABS	SHEETS	REPL	UNITS
TENSILE STRENGTH	C81-C82	61	4	2658.	92.	62.	71.	POUNDS PER SQUARE INCH
	C83-C84	61	4	2679.	87.	68.	72.	POUNDS PER SQUARE INCH
TENSILE STRENGTH	C81-C82	61	4	18.33	.63	.43	.49	MEGAPASCALS
	C83-C84	61	4	18.47	.60	.47	.49	MEGAPASCALS
ULTIMATE ELONGATION	C81-C82	62	3	626.	20.	9.	15.	PERCENT
	C83-C84	62	3	615.	20.	11.	15.	PERCENT
STRESS AT 300% ELONGATION	C81-C82	60	5	1115.	66.	24.	26.	POUNDS PER SQUARE INCH
	C83-C84	60	5	1137.	65.	32.	25.	POUNDS PER SQUARE INCH
STRESS AT 300% ELONGATION	C81-C82	60	5	7.688	.454	.167	.179	MEGAPASCALS
	C83-C84	60	5	7.844	.447	.221	.174	MEGAPASCALS

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER
REPORT 37 - 1 JULY 1978

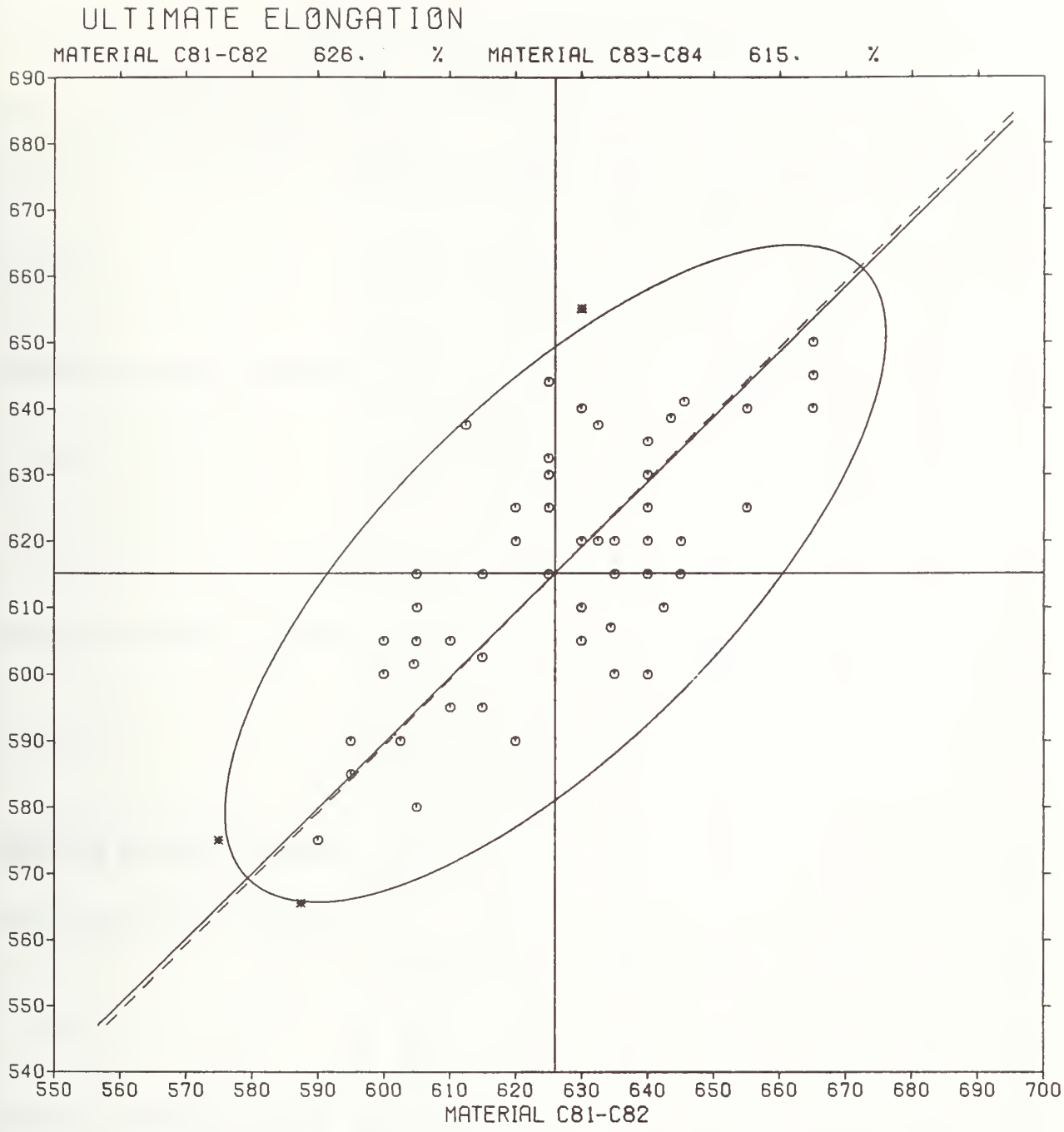
PRECISION OF METHODS

PROPERTY	MATERIAL	REPL CRP	REPL ASTM	GR. MEAN	ABSOLUTE REPEAT	REPROD	UNITS	PERCENT REPEAT	REPROD
TENSILE STRENGTH	C81-C82	5	5	2658.	195.	254.	PSI	7.4	9.6
	C83-C84	5	5	2679.	198.	242.	PSI	7.4	9.0
TENSILE STRENGTH	C81-C82	5	5	18.33	1.35	1.75	MEGAPA	7.4	9.6
	C83-C84	5	5	18.47	1.37	1.67	MEGAPA	7.4	9.0
ULTIMATE ELONGATION	C81-C82	5	5	626.	43.	55.	%	6.8	8.8
	C83-C84	5	5	615.	41.	54.	%	6.7	8.8
STRESS AT 300% ELONGATION	C81-C82	5	5	1115.	72.	182.	PSI	6.4	16.3
	C83-C84	5	5	1137.	70.	180.	PSI	6.1	15.8
STRESS AT 300% ELONGATION	C81-C82	5	5	7.688	.496	1.257	MEGAPA	6.4	16.3
	C83-C84	5	5	7.844	.481	1.238	MEGAPA	6.1	15.8

LAB CODE	F	MATERIAL C81-C82 COMMERCIAL TIRE TREAD MEAN PSI	MEAN MEGAPA	% DEV	REL SDR	MATERIAL C83-C84 SBR MEAN PSI	MEAN MEGAPA	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0066		2665.	18.38	.3	.98	2675.	18.45	-.1	.98	01	
V0067		2632.	18.16	-.9	.36	2640.	18.21	-1.4	.59	01	
V0069		2717.	18.74	2.3	1.19	2660.	18.34	-.7	1.24	01	
V0070		2582.	17.81	-2.8	1.54	2723.	18.78	1.7	1.60	01	
V0071		2614.	18.03	-1.6	1.32	2598.	17.92	-3.0	1.20	01	
V0072		2730.	18.83	2.7	1.23	2730.	18.83	1.9	1.48	01	
V0073		2725.	18.79	2.5	.65	2687.	18.53	.3	.91	01	
V0076		2645.	18.24	-.5	1.37	2610.	18.00	-2.6	2.08X	01	
V0078		2489.	17.17	-6.3	1.29	2551.	17.60	-4.8	.75	01	
V0081		2725.	18.79	2.5	1.19	2800.	19.31	4.5	1.22	01	
V0083		2537.	17.50	-4.5	.67	2555.	17.62	-4.6	.34	01	
V0084		2615.	18.03	-1.6	.98	2725.	18.79	1.7	1.31	01	
V0085		2676.	18.45	.7	2.19X	2727.	18.80	1.8	.74	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0087		2525.	17.41	-5.0	2.99X	2620.	18.07	-2.2	.94	01	
V0088		2563.	17.68	-3.6	.98	2661.	18.35	-.7	.92	01	
V0092	X	2330.	16.07	-12.3	.39	2365.	16.31	-11.7	.53	01	
V0095		2715.	18.72	2.2	.77	2725.	18.79	1.7	.81	01	
V0096		2563.	17.68	-3.5	1.02	2547.	17.57	-4.9	2.99X	01	
V0100		2655.	18.31	-.1	1.14	2730.	18.83	1.9	.67	01	
V0102		2505.	17.28	-5.7	1.61	2545.	17.55	-5.0	1.01	01	
V0111		2590.	17.86	-2.5	1.56	2685.	18.52	.2	.54	01	
V0117		2705.	18.66	1.8	.74	2657.	18.33	-.8	.60	01	
V0120		2696.	18.59	1.4	.67	2697.	18.60	.7	.75	01	
V0122		2550.	17.59	-4.0	.93	2577.	17.78	-3.8	1.37	01	
V0123		2720.	18.76	2.3	.74	2770.	19.10	3.4	.54	01	
V0126		2756.	19.00	3.7	.47	2756.	19.00	2.9	.98	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0128		2670.	18.41	.5	.71	2645.	18.24	-1.3	1.52	01	
V0141		2734.	18.86	2.9	.87	2805.	19.35	4.7	.94	01	
V0144		2785.	19.21	4.8	.87	2725.	18.79	1.7	.85	01	
V0144B		2800.	19.31	5.4	.88	2865.	19.76	6.9	.69	01	
V0146		2632.	18.16	-.9	1.09	2670.	18.41	-.3	.90	01	
V0150		2517.	17.36	-5.3	.51	2512.	17.33	-6.2	.46	01	
V0152	*	2795.	19.28	5.2	.65	2660.	18.34	-.7	1.57	01	
V0153		2532.	17.46	-4.7	.43	2513.	17.33	-6.2	1.86	01	
V0154		2750.	18.97	3.5	.89	2765.	19.07	3.2	1.00	01	
V0156		2655.	18.31	-.1	1.40	2740.	18.90	2.3	.59	01	
V0158		2502.	17.25	-5.9	1.25	2589.	17.85	-3.4	.51	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0160		2640.	18.20	-.7	1.14	2567.	17.70	-4.2	.83	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0166		2706.	18.66	1.8	.99	2696.	18.59	.6	1.29	01	
V0168		2815.	19.41	5.9	1.05	2775.	19.14	3.6	1.07	01	
V0169		2654.	18.30	-.1	.98	2589.	17.85	-3.4	.91	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0176		2570.	17.72	-3.3	.66	2590.	17.86	-3.3	.85	01	
V0177		2680.	18.48	.8	1.32	2705.	18.66	1.0	1.75	01	
V0178	X	2640.	18.21	-.7	1.84	2200.	15.17	-17.9	2.29X	01	
V0184		2728.	18.82	2.7	.81	2659.	18.34	-.7	.94	01	
V0190		2600.	17.93	-2.2	1.03	2683.	18.51	.2	1.33	01	
V0199		2860.	19.72	7.6	1.00	2830.	19.52	5.6	1.07	01	
V0200		2759.	19.03	3.8	.85	2844.	19.62	6.2	.82	01	
V0206		2760.	19.03	3.9	1.20	2850.	19.66	6.4	1.18	01	
V0207		2595.	17.90	-2.4	.42	2585.	17.83	-3.5	1.36	01	
V0208		2719.	18.75	2.3	1.14	2748.	18.95	2.6	1.01	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0213		2690.	18.55	1.2	.57	2651.	18.29	-1.0	.74	01	
V0214		2582.	17.80	-2.9	.36	2661.	18.35	-.6	.71	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0220		2750.	18.97	3.5	1.07	2762.	19.05	3.1	1.21	01	
V0223		2590.	17.86	-2.5	1.70	2715.	18.72	1.3	.84	01	
V0224		2680.	18.48	.8	1.74	2650.	18.28	-1.1	1.90	01	
V0225		2504.	17.27	-5.8	2.33X	2514.	17.34	-6.1	.88	01	
V0233		2576.	17.77	-3.1	1.50	2638.	18.19	-1.5	.72	01	
V0235	X	2182.	15.05	-17.9	1.79	2109.	14.54	-21.3	.80	01	
V0238		2745.	18.93	3.3	.91	2735.	18.86	2.1	.86	01	
V0243		2557.	17.63	-3.8	1.64	2700.	18.62	.8	1.31	01	
V0244		2574.	17.75	-3.1	.62	2610.	18.00	-2.6	.83	21	ORIGINAL IN KILOGRAMS/SQ. CENTIMETER
V0245A		2716.	18.73	2.2	1.17	2717.	18.74	1.4	1.46	01	
V0245B	X	4075.	28.10	53.3	1.28	4011.	27.66	49.7	1.40	01	
V0250		2787.	19.22	4.9	1.16	2787.	19.22	4.1	.73	01	
		2658.	18.33	* GR. MEAN *		2679.	18.47				5 TEST DETERMINATIONS
		92.	.63	* SD MEANS *		87.	.60				61 LABORATORIES IN GRAND MEANS
		71.	.49	* AVER SDR *		72.	.49				65 LABORATORIES REPORTING
		PSI	MEGAPA	* UNIT *		PSI	MEGAPA				

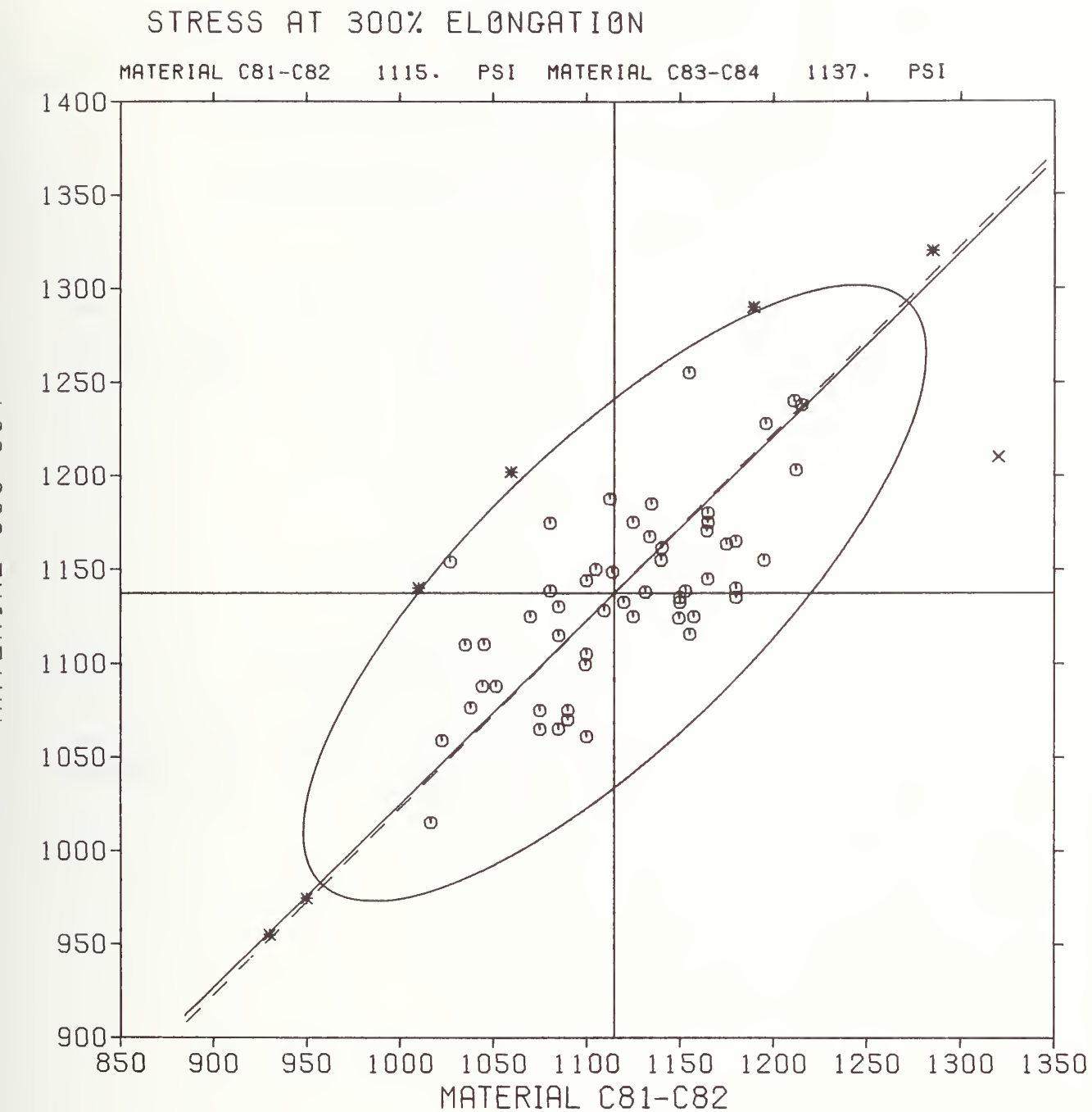

TENSILE STRENGTH
MATERIAL C81-C82 2658. PSI MATERIAL C83-C84 2679. PSI
3050
3000
2950
2900
2850
2800
2750
2700
2650
2600
2550
2500
2450
2400
2350
2300 2350 2400 2450 2500 2550 2600 2650 2700 2750 2800 2850 2900 2950 3000
MATERIAL C81-C82

LAB CODE	F	MATERIAL C81-C82 COMMERCIAL TIRE TREAD MEAN %	% DEV	REL SDR	MATERIAL C83-C84 SBR MEAN %	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0066		640.	2.2	1.11	620.	.8	1.10	01	
V0067		605.	-3.3	.38	580.	-5.7	.32	01	
V0069		640.	2.2	1.15	625.	1.6	1.22	01	
V0070		642.	2.6	.89	610.	-.8	.77	01	
V0071		602.	-3.7	1.37	590.	-4.1	1.30	01	
V0072		640.	2.2	.78	625.	1.6	1.70	01	
V0073		640.	2.2	.50	625.	1.6	1.16	01	
V0076		610.	-2.5	1.47	595.	-3.3	2.26X	01	
V0078	X	565.	-9.7	1.12	545.	-11.4	1.34	01	
V0081		625.	-.1	1.05	615.	-.0	1.43	01	
V0083		615.	-1.7	.75	602.	-2.1	.82	01	
V0084		605.	-3.3	1.12	610.	-.8	1.08	01	
V0085		655.	4.6	2.42X	640.	4.0	1.02	01	
V0087		604.	-3.4	3.36X	601.	-2.2	1.44	01	
V0088		612.	-2.1	1.02	637.	3.6	1.02	01	
V0092	*	575.	-8.1	.82	575.	-6.5	.65	01	
V0095		615.	-1.7	1.06	595.	-3.3	.98	01	
V0096	*	587.	-6.1	1.00	565.	-8.1	2.15X	01	
V0100		640.	2.2	1.34	630.	2.4	.77	01	
V0102		625.	-.1	1.63	630.	2.4	.86	01	
V0111		645.	3.1	2.09X	641.	4.2	1.00	01	
V0117		645.	3.0	.50	620.	.8	.97	01	
V0120		625.	-.1	.60	615.	-.0	.73	01	
V0122		665.	6.2	1.28	640.	4.0	1.65	01	
V0123		630.	.6	.69	640.	4.0	.46	01	
V0126		643.	2.8	.91	638.	3.8	.78	01	
V0128		640.	2.2	.66	615.	-.0	1.63	01	
V0141		640.	2.2	1.44	635.	3.2	.84	01	
V0144		630.	.6	1.98X	610.	-.8	1.06	01	
V0144B		620.	-.9	1.84	620.	.8	.83	01	
V0146		632.	1.0	.96	637.	3.6	1.41	01	
V0150		595.	-4.9	.56	590.	-4.1	.74	01	
V0152		640.	2.2	.81	600.	-2.5	1.56	01	
V0153		645.	3.0	.29	615.	-.0	1.39	01	
V0154		635.	1.4	.66	615.	-.0	.99	01	
V0156		590.	-5.7	1.82	575.	-6.5	.63	01	
V0158		625.	-.1	1.51	632.	2.8	1.14	01	
V0160		630.	.6	1.57	605.	-1.6	.62	01	
V0166		615.	-1.7	.50	615.	-.0	.88	01	
V0168		630.	.6	.44	620.	.8	.48	01	
V0169		640.	2.2	.64	615.	-.0	.86	01	
V0176		605.	-3.3	.79	605.	-1.6	1.08	01	
V0177	*	630.	.6	1.20	655.	6.5	.58	01	
V0178	X	626.	.0	1.97X	515.	-16.2	2.50X	01	
V0184		640.	2.2	.81	600.	-2.5	.82	01	
V0190		635.	1.4	1.13	600.	-2.5	1.52	01	
V0199		625.	-.1	1.78	644.	4.7	1.18	01	
V0200		640.	2.2	.65	630.	2.4	.72	01	
V0206		610.	-2.5	.83	605.	-1.6	.81	01	
V0207		600.	-4.1	.00	600.	-2.5	1.08	01	
V0208		600.	-4.1	1.04	600.	-2.5	1.60	01	
V0213		634.	1.4	.66	607.	-1.3	.80	01	
V0214		635.	1.4	.42	620.	.8	.69	01	
V0220		625.	-.1	1.25	625.	1.6	.77	01	
V0223		605.	-3.3	1.22	615.	-.0	1.29	01	
V0224		632.	1.0	1.92	620.	.8	1.67	01	
V0225		595.	-4.9	1.23	585.	-4.9	.73	01	
V0233		600.	-4.1	.93	605.	-1.6	.69	01	
V0235	X	500.	-20.1	1.51	480.	-22.0	.58	01	
V0238		630.	.6	.84	620.	.8	1.05	01	
V0243		620.	-.9	1.69	625.	1.6	.99	01	
V0244		620.	-.9	.75	590.	-4.1	.67	01	
V0245A		655.	4.6	.67	625.	1.6	1.07	01	
V0245B		665.	6.2	.77	645.	4.9	.89	01	
V0250		665.	6.2	1.32	650.	5.7	1.00	01	
		626.	= GR. MEAN =		615.				5 TEST DETERMINATIONS
		20.	= SD MEANS =		20.				62 LABORATORIES IN GRAND MEANS
		15.	= AVER SDR =		15.				65 LABORATORIES REPORTING
		%	= UNIT =		%				


ULTIMATE ELØNGATIØN
MATERIAL C81-C82 626. %
MATERIAL C83-C84 615. %
690
680
670
660
650
640
630
620
610
600
590
580
570
560
550
540
550 560 570 580 590 600 610 620 630 640 650 660 670 680 690 700
MATERIAL C81-C82

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER
STRESS AT 300% ELONGATION - POUNDS PER SQUARE INCH

LAB CODE	F	MATERIAL C81-C82 COMMERCIAL TIRE TREAD MEAN PSI	MEAN MEGAPA	% DEV	REL SDR	MATERIAL C83-C84 SBR MEAN PSI	MEAN MEGAPA	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0066		1035.	7.138	-7.2	1.28	1110.	7.655	-2.4	1.89	01	
V0067		1215.	8.379	9.0	.60	1238.	8.538	8.8	.54	01	
V0069	X	558.	3.852	-49.9	.62	560.	3.862	-50.8	.68	01	
V0070		1027.	7.083	-7.9	1.13	1154.	7.959	1.5	1.29	01	
V0071		1134.	7.821	1.7	2.22X	1167.	8.052	2.7	1.17	01	
V0072		1085.	7.483	-2.7	1.21	1130.	7.793	-.6	.80	01	
V0073		1157.	7.983	3.8	1.11	1125.	7.759	-1.1	.74	01	
V0076		1165.	8.034	4.5	.87	1145.	7.897	.7	.93	01	
V0078	*	1189.	8.203	6.7	2.42X	1290.	8.897	13.4	1.79	01	
V0081		1112.	7.672	-.2	.48	1187.	8.190	4.4	.54	01	
V0083		1150.	7.931	3.2	1.03	1135.	7.828	-.2	1.24	01	
V0084		1105.	7.621	-.9	.96	1150.	7.931	1.1	.54	01	
V0085		1081.	7.452	-3.1	.48	1139.	7.852	.1	.84	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0087		1135.	7.828	1.8	1.15	1185.	8.172	4.2	.74	01	
V0088		1022.	7.052	-8.3	1.97X	1059.	7.303	-6.9	1.82	01	
V0092		1085.	7.483	-2.7	.59	1065.	7.345	-6.4	1.33	01	
V0095		1125.	7.759	.9	1.21	1175.	8.103	3.3	.54	01	
V0096		1196.	8.248	7.3	.55	1228.	8.469	8.0	7.79X	01	
V0100	*	1010.	6.966	-9.4	1.13	1140.	7.862	.2	.98	01	
V0102	*	930.	6.414	-16.6	.76	955.	6.586	-16.0	.91	01	
V0111		1045.	7.207	-6.3	.94	1110.	7.655	-2.4	.84	01	
V0117		1120.	7.724	.5	1.02	1132.	7.810	-.4	1.09	01	
V0120		1164.	8.031	4.5	.97	1170.	8.072	2.9	.91	01	
V0122	X	885.	6.103	-20.6	.93	902.	6.224	-20.6	.49	01	
V0123		1180.	8.138	5.9	.41	1135.	7.828	-.2	.90	01	
V0126		1099.	7.582	-1.4	1.03	1099.	7.582	-3.3	.73	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0128		1085.	7.483	-2.7	.65	1115.	7.690	-2.0	.63	01	
V0141		1114.	7.683	-.1	1.23	1148.	7.921	1.0	1.02	01	
V0144		1090.	7.517	-2.2	.73	1070.	7.379	-5.9	1.03	01	
V0144B		1165.	8.034	4.5	1.39	1175.	8.103	3.3	.78	01	
V0146		1100.	7.586	-1.3	1.44	1061.	7.317	-6.7	1.30	01	
V0150		1090.	7.517	-2.2	.59	1075.	7.414	-5.5	.60	01	
V0152		1140.	7.862	2.3	.62	1155.	7.966	1.6	.63	01	
V0153	*	950.	6.552	-14.8	1.28	974.	6.721	-14.3	1.50	01	
V0154		1180.	8.138	5.9	.93	1165.	8.034	2.4	.32	01	
V0156	*	1285.	8.862	15.3	2.47X	1320.	9.103	16.1	.97	01	
V0158		1044.	7.202	-6.3	1.84	1088.	7.502	-4.4	1.39	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0160		1153.	7.952	3.4	.57	1139.	7.852	.1	1.57	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0166		1155.	7.969	3.7	.46	1115.	7.693	-1.9	.87	01	
V0168		1149.	7.928	3.1	1.04	1124.	7.752	-1.2	.39	01	
V0169		1052.	7.252	-5.7	.90	1088.	7.502	-4.4	1.31	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0176		1165.	8.034	4.5	1.93	1180.	8.138	3.7	1.24	01	
V0177		1075.	7.414	-3.6	1.30	1065.	7.345	-6.4	.93	01	
V0178		1070.	7.379	-4.0	.42	1125.	7.759	-1.1	1.02	01	
V0184		1180.	8.138	5.9	1.05	1140.	7.862	.2	1.01	01	
V0190		1100.	7.586	-1.3	.79	1144.	7.890	.6	1.09	01	
V0199	X	1320.	9.103	18.4	3.84X	1210.	8.345	6.4	2.95X	01	
V0200		1109.	7.652	-.5	.71	1128.	7.779	-.8	.68	01	
V0206		1155.	7.966	3.6	1.19	1255.	8.655	10.3	1.16	01	
V0207		1195.	8.241	7.2	1.36	1155.	7.966	1.6	2.00X	01	
V0208		1211.	8.352	8.6	1.36	1240.	8.552	9.0	1.40	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0213		1131.	7.803	1.5	1.68	1138.	7.848	.1	1.12	01	
V0214		1081.	7.452	-3.1	.66	1175.	8.102	3.3	1.36	20	ORIGINAL IN MEGANEWTONS PER SQ.METER
V0220		1075.	7.414	-3.6	.46	1075.	7.414	-5.5	.90	01	
V0223		1150.	7.931	3.2	.88	1132.	7.810	-.4	.75	01	
V0224	X	1425.	9.828	27.8	1.29	1162.	8.017	2.2	1.49	01	
V0225		1175.	8.103	5.4	.97	1163.	8.024	2.3	.99	01	
V0233		1140.	7.866	2.3	1.42	1161.	8.010	2.1	.83	01	
V0235		1212.	8.359	8.7	.95	1203.	8.297	5.8	.63	01	
V0238		1100.	7.586	-1.3	1.07	1105.	7.621	-2.8	.92	01	
V0243		1038.	7.159	-6.9	1.26	1076.	7.424	-5.4	1.22	01	
V0244	*	1060.	7.308	-4.9	1.03	1202.	8.289	5.7	1.15	21	ORIGINAL IN KILOGRAMS/SQ. CENTIMETER
V0245A		1016.	7.010	-8.8	1.87	1015.	7.000	-10.8	1.49	01	
V0245B	X	1522.	10.497	36.5	.98	1507.	10.397	32.5	1.45	01	
V0250		1125.	7.759	.9	.68	1125.	7.759	-1.1	.69	01	
		1115.	7.688	* GR. MEAN *		1137.	7.844				5 TEST DETERMINATIONS
		66.	.454	* SD MEANS *		65.	.447				60 LABORATORIES IN GRAND MEANS
		26.	.179	* AVER SDR *		25.	.174				65 LABORATORIES REPORTING
		PSI	MEGAPA	* UNIT *		PSI	MEGAPA				


STRESS AT 300% ELØNGATIØN
MATERIAL C81-C82 1115. PSI MATERIAL C83-C84 1137. PSI
1400
1350
1300
1250
1200
1150
1100
1050
1000
950
900
850
900
950
1000
1050
1100
1150
1200
1250
1300
1350
MATERIAL C81-C82

HARDNESS

NOTES

Materials C81 and C82 were sheets of the same vulcanized rubber. Similarly, materials C83 and C84 were alike.

V100 results were obtained at NBS using ASTM D2240.

Five of the 33 participants reporting used ASTM D1415 (Wallace) for the hardness determination. One participant did not report the instrument used. All others used ASTM D2240 (Type A Durometer).

SUMMARY OF ANALYSES

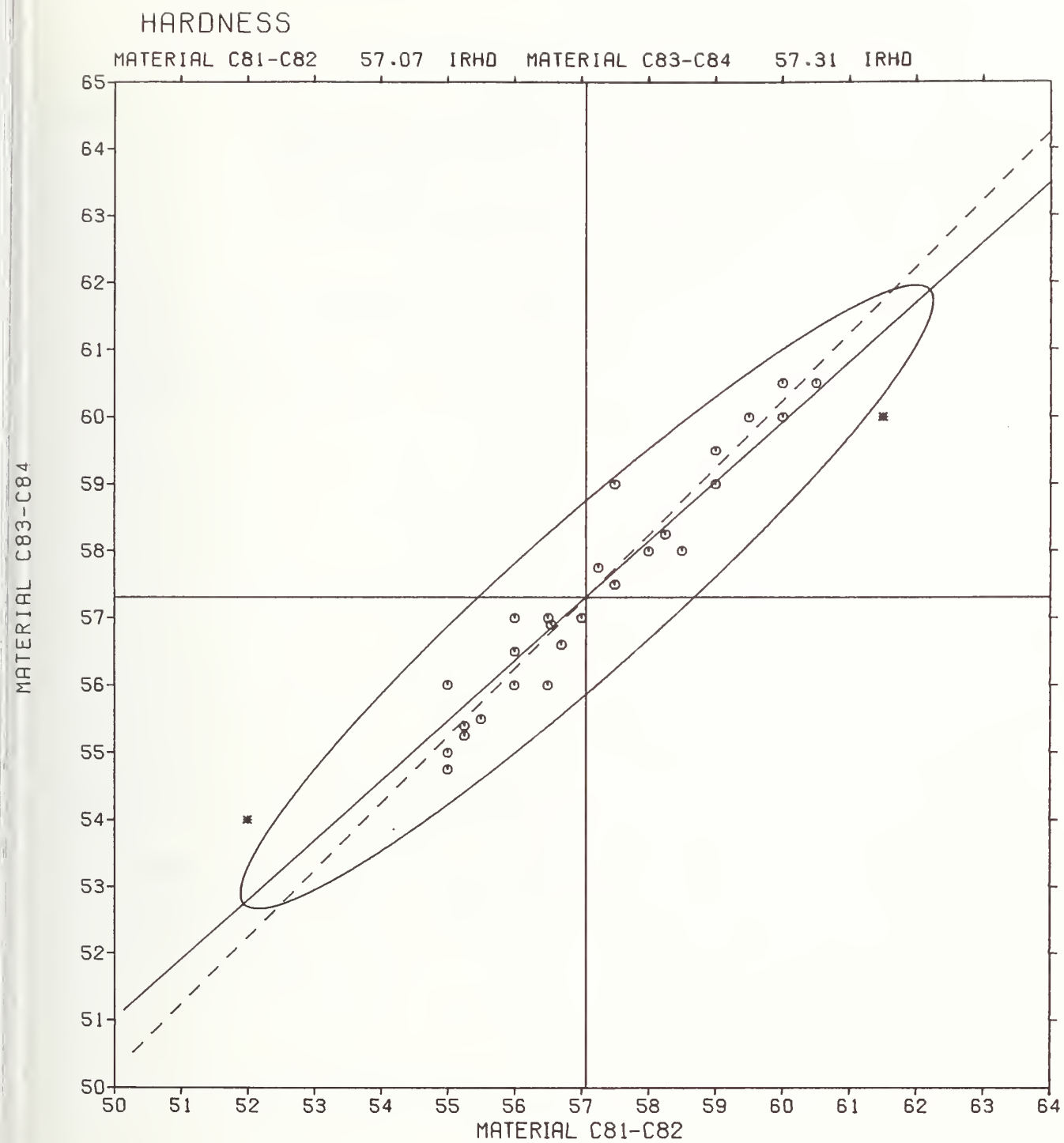
PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR. MEAN	STD DEVIATIONS LABS	SHEETS	REPL	UNITS
HARDNESS	C81-C82	32	1	57.07	1.98	.23	.42	IRHD
	C83-C84	32	1	57.31	1.77	.13	.51	IRHD

INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER
REPORT 37 - 2 JULY 1978

PRECISION OF METHODS

PROPERTY	MATERIAL	REPL CRP	REPL ASTM	GR. MEAN	ABSOLUTE REPEAT	REPROD	UNITS	PERCENT REPEAT	REPROD
HARDNESS	C81-C82	5	5	57.07	1.17	5.48	IRHD	2.0	9.6
	C83-C84	5	5	57.31	1.42	4.91	IRHD	2.5	8.6

		MATERIAL C81-C82 COMMERCIAL TIRE TREAD			MATERIAL C83-C84 SBR				
LAB CODE	F	MEAN IRHD	% REL DEV	REL SDR	MEAN IRHD	% REL DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0069		57.25	.3	.84	57.75	.8	1.30	01	
V0070	*	61.50	7.8	2.29X	60.00	4.7	1.23	01	
V0071		59.00	3.4	.00	59.00	3.0	.00	01	
V0072		60.00	5.1	1.88	60.50	5.6	2.79X	01	
V0078		56.50	-1.0	1.18	57.00	-.5	1.07	01	
V0081		56.50	-1.0	1.30	57.00	-.5	1.41	01	
V0084		57.00	-.1	.00	57.00	-.5	.97	01	
V0085		56.70	-.6	.62	56.60	-1.2	.56	01	
V0087		60.50	6.0	.00	60.50	5.6	.00	01	
V0088		56.00	-1.9	1.98X	57.00	-.5	1.07	01	
V0092		56.00	-1.9	1.06	57.00	-.5	1.07	01	
V0095		57.00	-.1	.53	57.00	-.5	.00	01	
V0100		55.25	-3.2	.65	55.25	-3.6	.53	01	
V0102		60.00	5.1	.99	60.00	4.7	1.73	01	
V0111		58.00	1.6	.53	58.00	1.2	.97	01	
V0122		56.00	-1.9	.53	56.50	-1.4	.49	01	
V0128	*	52.00	-8.9	1.64	54.00	-5.8	1.25	01	
V0141	X	50.50	-11.5	1.49	49.50	-13.6	.97	01	
V0144		59.00	3.4	.65	59.50	3.8	.44	01	
V0144B		59.50	4.3	1.30	60.00	4.7	1.41	01	
V0168		58.25	2.1	.74	58.25	1.6	1.02	01	
V0169		55.00	-3.6	.53	55.00	-4.0	.44	01	
V0176		56.00	-1.9	1.49	56.00	-2.3	.97	01	
V0190		57.50	.8	.65	59.00	3.0	.97	01	
V0200		55.25	-3.2	.75	55.40	-3.3	1.06	01	
V0206		58.50	2.5	1.18	58.00	1.2	.53	01	
V0208		55.50	-2.8	1.90	55.50	-3.2	1.55	01	
V0214		56.55	-.9	2.70X	56.90	-.7	1.81	01	
V0224		55.00	-3.6	1.06	56.00	-2.3	.69	01	
V0233		57.50	.8	1.18	57.50	.3	1.41	01	
V0235		55.00	-3.6	1.30	54.75	-4.5	.49	01	
V0243		56.50	-1.0	.53	56.00	-2.3	.44	01	
V0244		56.00	-1.9	.99	56.00	-2.3	1.13	01	
		57.07	* GR. MEAN *		57.31				5 TEST DETERMINATIONS
		1.98	* SD MEANS *		1.77				32 LABORATORIES IN GRAND MEANS
		.42	* AVER SDR *		.51				33 LABORATORIES REPORTING
		IRHD	* UNIT *		IRHD				


HARDNESS
MATERIAL C81-C82 57.07 IRHD MATERIAL C83-C84 57.31 IRHD
MATERIAL C83-C84
MATERIAL C81-C82
65
64
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50 51 52 53 54 55 56 57 58 59 60 61 62 63 64

MOONEY VISCOSTIY

NOTES

Materials T81 and T82 were the same rubber. Similarly, materials T83 and T84 were the same rubber. No sample preparation was required for materials T81 and T82 whereas, mill massing was required for materials T83 and T84.

V100 results were obtained at NBS on the manually closed viscometer used for determining the Mooney viscosities of the standard rubbers.

SUMMARY OF ANALYSES

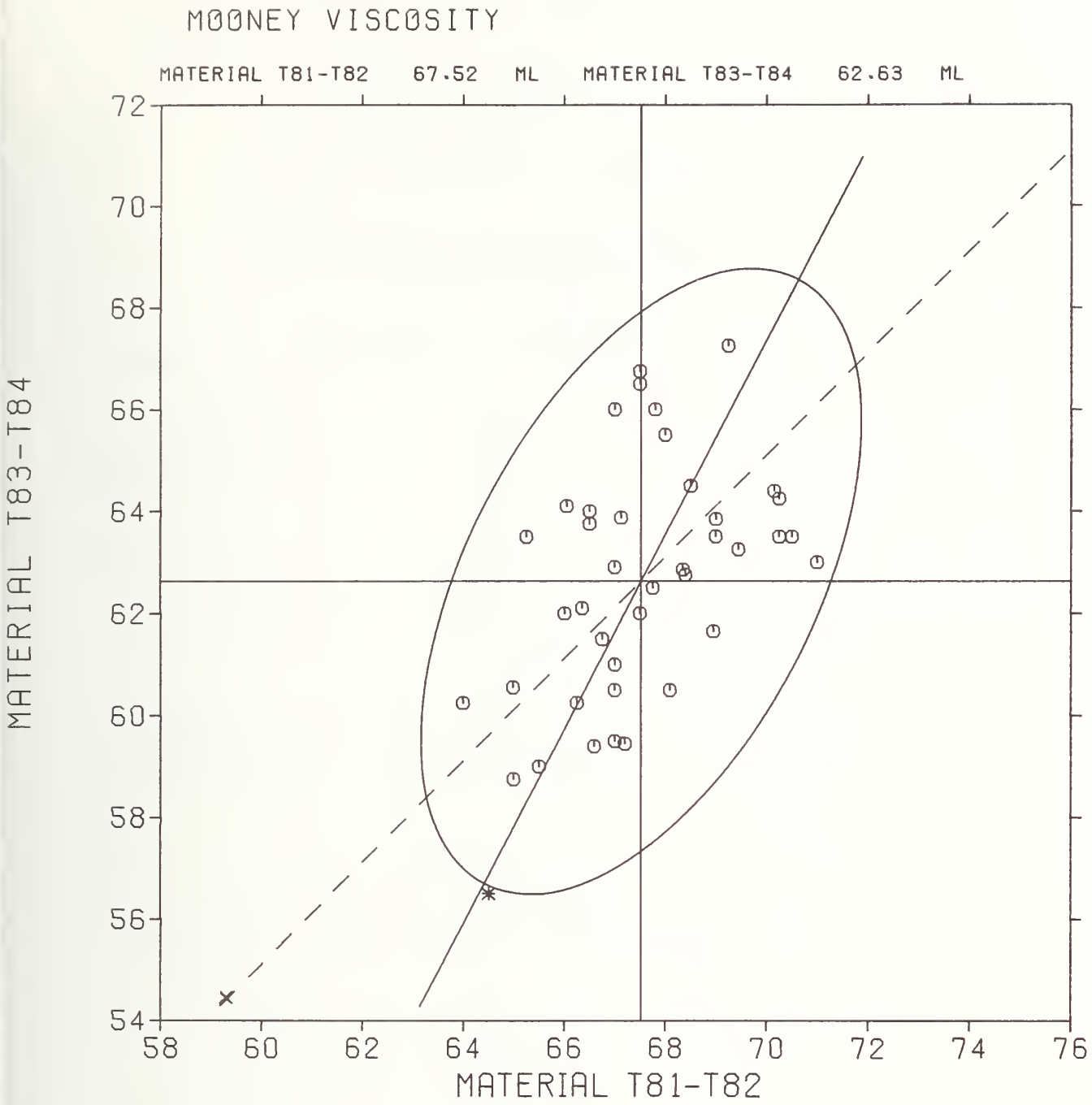
PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR.MEAN	STD DEVIATIONS LABS	SHEETS	REPL	UNITS
MOONEY VISCOSITY	T81-T82	42	3	67.52	1.69	.14	.38	ML
	T83-T84	42	3	62.63	2.38	.42	.41	ML

REPORT 37 - 4 INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER AUGUST 1978

PRECISION OF METHODS

PROPERTY	MATERIAL	REPL CRP	REPL ASTM	GR.MEAN	ABSOLUTE REPEAT	REPROD	UNITS	PERCENT REPEAT	REPROD
MOONEY VISCOSITY	T81-T82	3	3	67.52	1.05	4.69	ML	1.6	6.9
	T83-T84	3	3	62.63	1.13	6.61	ML	1.8	10.5

LAB CODE	F	MATERIAL T81-T82 BUTYL RUBBER MEAN ML	% DEV	REL SDR	MATERIAL T83-T84 SBR MEAN ML	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0068		67.50	-.0	.76	66.50	6.2	5.50X	01	
V0071	X	67.00	-.8	.53	53.00	-15.4	.35	01	
V0072	*	64.50	-4.5	2.29	56.50	-9.8	1.41	01	
V0073		66.25	-1.9	1.58	60.25	-3.8	.85	01	
V0077		66.60	-1.4	.81	59.40	-5.2	.98	01	
V0078	X	62.35	-7.7	1.93	53.00	-15.4	3.02X	01	
V0080		67.80	.4	1.22	66.00	5.4	1.48	01	
V0083		70.15	3.9	1.04	64.40	2.8	1.19	01	
V0085		70.25	4.0	1.32	63.50	1.4	1.22	01	
V0090		68.10	.9	.58	60.50	-3.4	.00	01	
V0092		68.00	.7	1.53	65.50	4.6	.00	01	
V0095		65.00	-3.7	1.77	58.75	-6.2	1.54	01	
V0100		68.40	1.3	.75	62.75	.2	.35	01	
V0111	X	59.30	-12.2	1.56	54.45	-13.1	.40	01	
V0117		69.00	2.2	1.67	63.50	1.4	1.97	01	
V0122		66.50	-1.5	.66	63.75	1.8	.96	01	
V0128		69.25	2.6	.76	67.25	7.4	.35	01	
V0144		67.75	.3	1.27	62.50	-.2	1.22	01	
V0146		66.75	-1.1	1.04	61.50	-1.8	.61	01	
V0148		67.00	-.8	1.53	60.50	-3.4	2.63X	01	
V0149		68.35	1.2	1.23	62.85	.4	.24	01	
V0150		65.00	-3.7	1.44	60.55	-3.3	.63	01	
V0156		67.12	-.6	1.23	63.87	2.0	1.40	01	
V0166		67.00	-.8	.76	66.00	5.4	.70	01	
V0169		67.50	-.0	.76	62.00	-1.0	.49	01	
V0177		66.05	-2.2	.61	64.10	2.4	1.02	01	
V0178		67.00	-.8	.15	62.90	.4	.28	01	
V0182		70.50	4.4	1.04	63.50	1.4	.96	01	
V0190		68.95	2.1	.26	61.65	-1.6	.31	01	
V0206		65.50	-3.0	.76	59.00	-5.8	.70	01	
V0207		69.45	2.9	.58	63.25	1.0	.49	01	
V0208		67.00	-.8	.76	59.50	-5.0	1.41	01	
V0211		67.50	-.0	.76	66.75	6.6	.00	01	
V0213		64.00	-5.2	.38	60.25	-3.8	1.06	01	
V0214		65.25	-3.4	.76	63.50	1.4	1.57	01	
V0217		66.00	-2.2	.76	62.00	-1.0	1.57	01	
V0218		70.25	4.0	.38	64.25	2.6	.00	01	
V0220		69.00	2.2	.76	63.85	2.0	1.25	01	
V0223		68.50	1.5	.76	64.50	3.0	.96	01	
V0230		67.20	-.5	2.30	59.45	-5.1	.65	01	
V0236		71.00	5.2	1.53	63.00	.6	1.41	01	
V0238		67.00	-.8	.38	61.00	-2.6	3.27X	01	
V0244		66.50	-1.5	2.85X	64.00	2.2	4.65X	01	
V0250		69.00	2.2	.00	63.50	1.4	1.41	01	
V0251		66.35	-1.7	1.01	62.10	-.8	1.34	01	
		67.52	* GR. MEAN *		62.63				3 TEST DETERMINATIONS
		1.69	* SD MEANS *		2.38				42 LABORATORIES IN GRAND MEANS
		.38	* AVER SDR *		.41				45 LABORATORIES REPORTING
		ML	* UNIT *		ML				


MOONEY VISCOSITY
MATERIAL T81-T82 67.52 ML
MATERIAL T83-T84 62.63 ML
MATERIAL T83-T84
MATERIAL T81-T82
72
70
68
66
64
62
60
58
56
54
58
60
62
64
66
68
70
72
74
76

VULCANIZATION CHARACTERISTICS USING OSCILLATING DISK CURE METER

NOTES

Materials Y81 and Y82 were the same rubber formulation. Similarly, materials Y83 and Y84 were alike.

V100 results were obtained at NBS using a model TM-100 Monsanto Rheometer with a disk oscillating at ±1° amplitude and 1.7 hertz frequency.

One participant used a Monsanto Rheometer operated at 10° Amplitude and 1.7 hertz frequency. All others used Monsanto Rheometers operated at one degree amplitude and 1.7 hertz frequency.

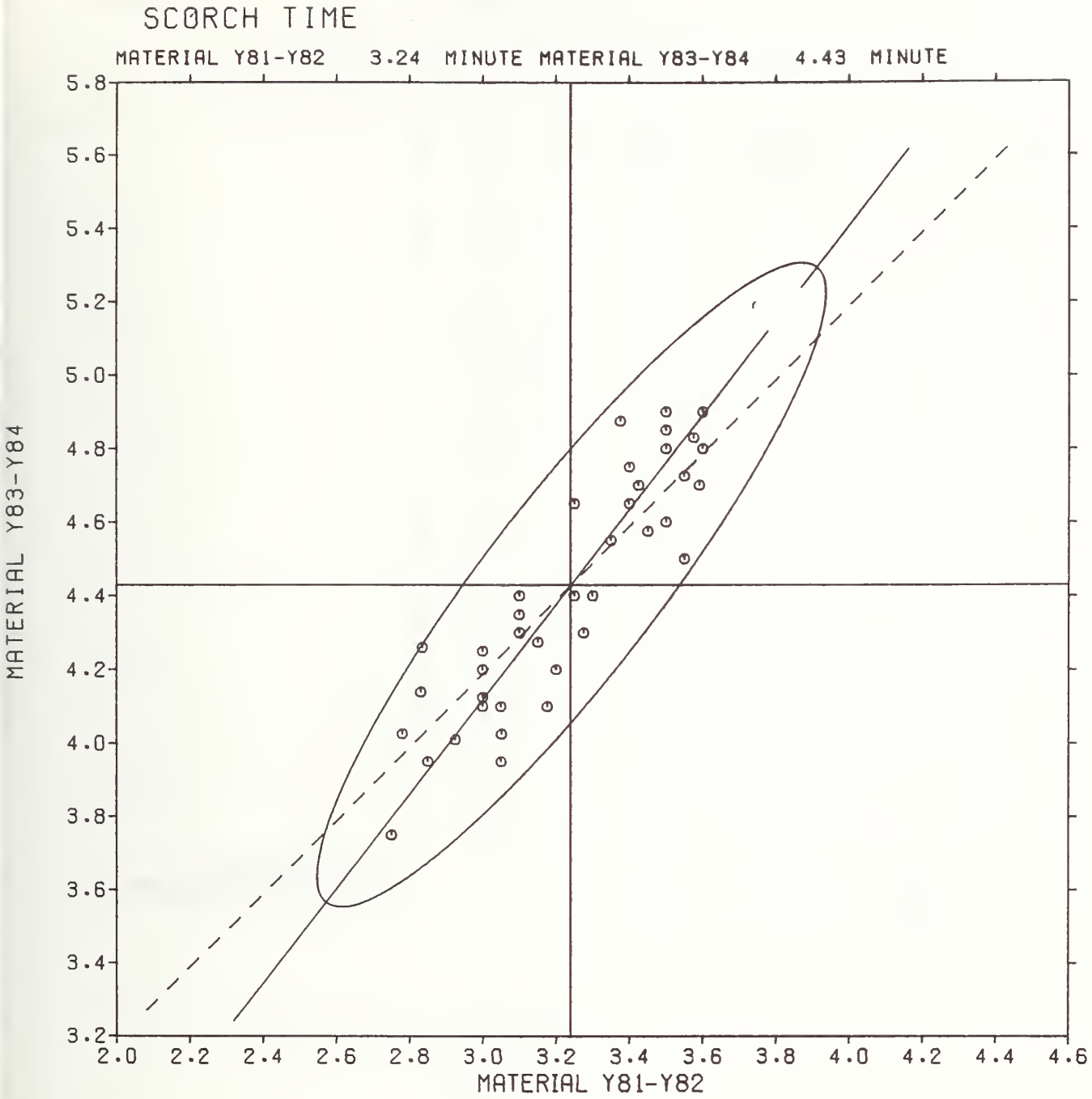
SUMMARY OF ANALYSES

PROPERTY	MATERIAL	LABS INCL	LABS OMIT	GR. MEAN	STD DEVIATIONS LABS	SHEETS	REPL	UNITS
SCORCH TIME	Y81-Y82	40	0	3.24	.27	.02	.07	MINUTES
	Y83-Y84	40	0	4.43	.34	.02	.06	MINUTES
CURE TIME (50% MH)	Y81-Y82	39	1	7.32	.49	.03	.07	MINUTES
	Y83-Y84	39	1	6.34	.43	.02	.07	MINUTES
CURE TIME (90% MH)	Y81-Y82	39	1	15.18	.93	.07	.11	MINUTES
	Y83-Y84	39	1	9.37	.64	.05	.12	MINUTES
MINIMUM TORQUE	Y81-Y82	36	4	6.47	.47	.03	.07	POUND-INCHES
	Y83-Y84	36	4	4.39	.37	.04	.07	POUND-INCHES
MINIMUM TORQUE	Y81-Y82	36	4	.7311	.0534	.0035	.0083	NEWTON-METERS
	Y83-Y84	36	4	.4957	.0423	.0047	.0077	NEWTON-METERS
MAXIMUM TORQUE	Y81-Y82	38	2	29.60	1.02	.08	.10	POUND-INCHES
	Y83-Y84	38	2	21.72	.89	.06	.11	POUND-INCHES
MAXIMUM TORQUE	Y81-Y82	38	2	3.3442	.1156	.0087	.0115	NEWTON-METERS
	Y83-Y84	38	2	2.4537	.1003	.0067	.0121	NEWTON-METERS

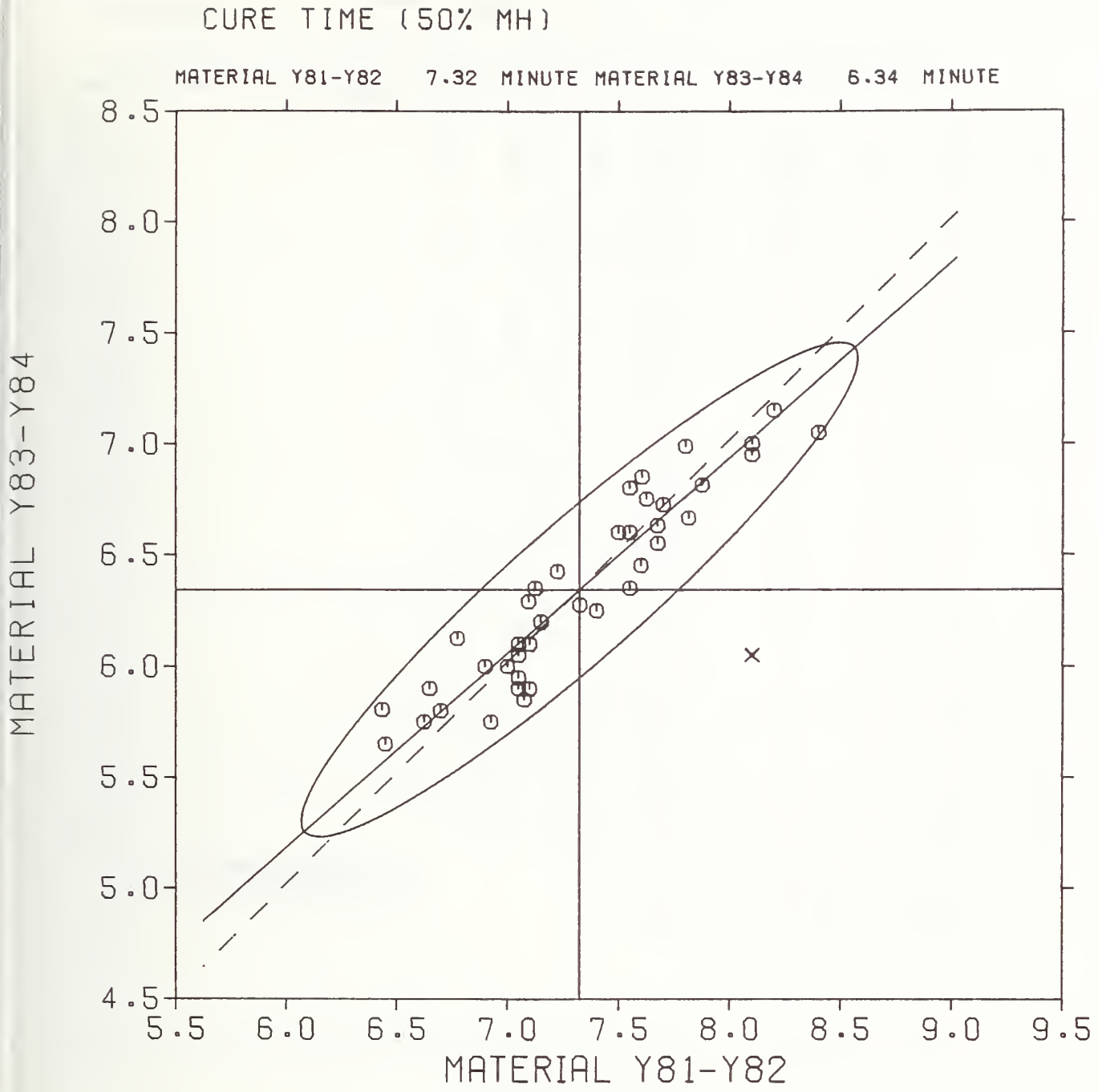
PRECISION OF METHODS

PROPERTY	MATERIAL	REPL CRP	REPL ASTM	GR. MEAN	ABSOLUTE REPEAT	REPROD	UNITS	PERCENT REPEAT	REPROD
SCORCH TIME	Y81-Y82	3	3	3.24	.20	.75	MINUTE	6.1	23.0
	Y83-Y84	3	3	4.43	.18	.94	MINUTE	4.0	21.2
CURE TIME (50% MH)	Y81-Y82	3	3	7.32	.21	1.34	MINUTE	2.8	18.4
	Y83-Y84	3	3	6.34	.20	1.19	MINUTE	3.2	18.8
CURE TIME (90% MH)	Y81-Y82	3	3	15.18	.31	2.59	MINUTE	2.0	17.1
	Y83-Y84	3	3	9.37	.34	1.77	MINUTE	3.6	18.9
MINIMUM TORQUE	Y81-Y82	3	3	6.47	.20	1.31	LB-IN.	3.1	20.2
	Y83-Y84	3	3	4.39	.19	1.04	LB-IN.	4.3	23.6
MINIMUM TORQUE	Y81-Y82	3	3	.7311	.0229	.1479	N-M	3.1	20.2
	Y83-Y84	3	3	.4957	.0212	.1172	N-M	4.3	23.6
MAXIMUM TORQUE	Y81-Y82	3	3	29.60	.28	2.83	LB-IN.	1.0	9.6
	Y83-Y84	3	3	21.72	.30	2.46	LB-IN.	1.4	11.3
MAXIMUM TORQUE	Y81-Y82	3	3	3.3442	.0318	.3202	N-M	1.0	9.6
	Y83-Y84	3	3	2.4537	.0335	.2777	N-M	1.4	11.3

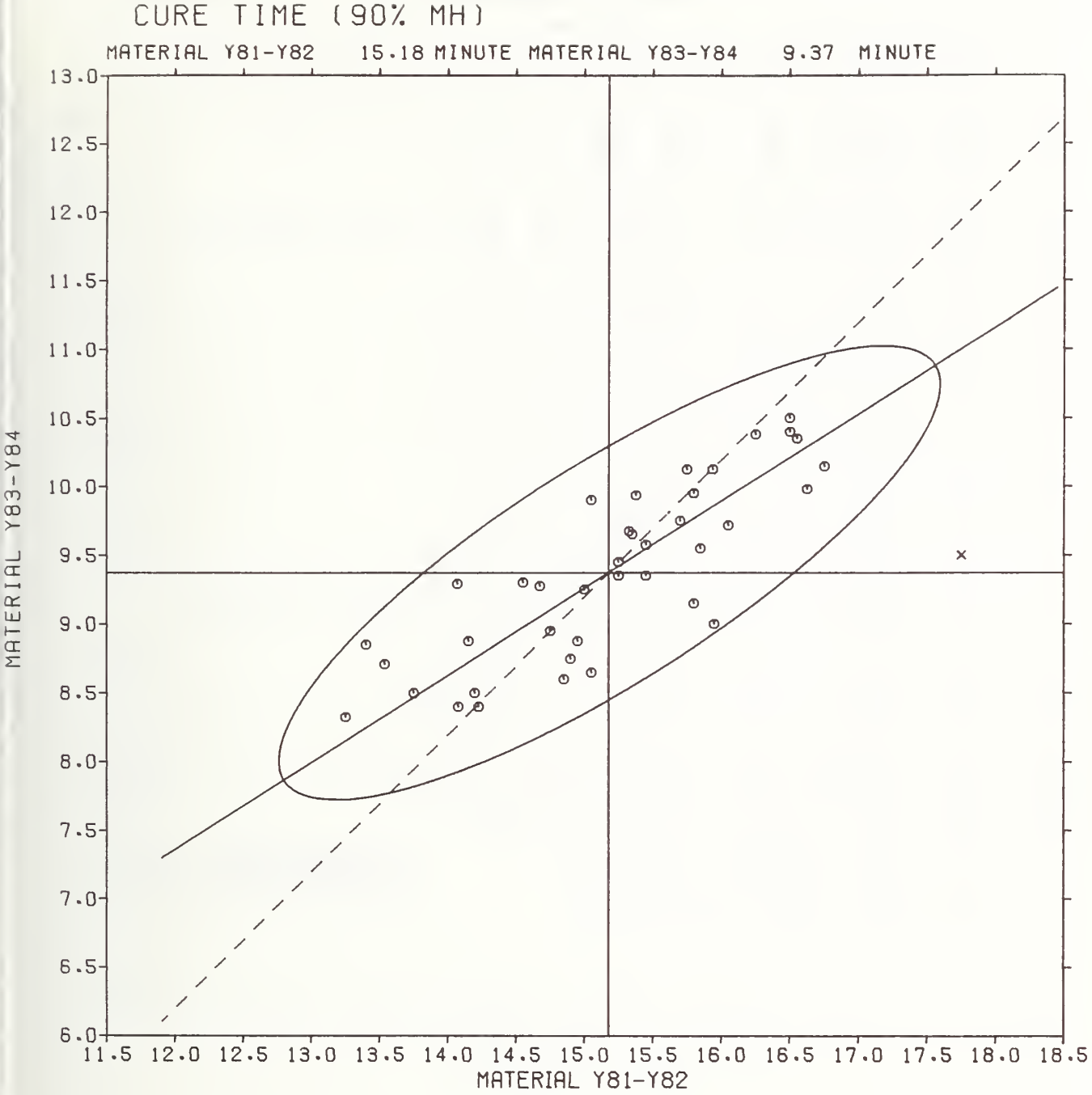
LAB CODE	F	MATERIAL Y81-Y82 COMMERCIAL TIRE TREAD MEAN MINUTE	% DEV	REL SDR	MATERIAL Y83-Y84 SBR MEAN MINUTE	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0071		3.25	.3	.40	4.40	-.7	.91	01	
V0074A		3.27	1.1	.75	4.30	-2.9	.00	01	
V0074B		3.57	10.3	2.13	4.83	9.1	1.40	01	
V0077		3.45	6.5	1.58	4.57	3.3	.23	01	
V0078		3.75	15.7	.50	5.19	17.1	1.35	01	
V0079		3.00	-7.4	.00	4.25	-4.0	.00	01	
V0083		3.60	11.1	1.10	4.90	10.6	.91	01	
V0085		2.75	-15.1	.00	3.75	-15.3	.23	01	
V0086		3.40	4.9	.81	4.75	7.3	.00	01	
V0090		3.59	10.8	.83	4.70	6.1	.73	01	
V0092		3.17	-2.0	.55	4.10	-7.4	1.36	01	
V0095		3.40	4.9	.00	4.65	5.0	.00	01	
V0100		3.25	.3	1.21	4.65	5.0	.91	01	
V0117		3.30	1.8	.81	4.40	-.7	1.57	01	
V0120		3.00	-7.4	.81	4.10	-7.4	2.11	01	
V0122		2.85	-12.1	1.10	3.95	-10.8	3.62X	01	
V0128		3.10	-4.3	.00	4.35	-1.8	1.24	01	
V0144		3.42	5.7	.63	4.70	6.1	.68	01	
V0146		3.37	4.1	2.02	4.87	10.1	2.27	01	
V0149		3.10	-4.3	.08	4.40	-.7	.68	01	
V0150		3.55	9.5	.88	4.50	1.6	.00	01	
V0152		3.35	3.4	.40	4.55	2.7	.45	01	
V0154		3.20	-1.3	.53	4.20	-5.2	.23	01	
V0156		3.55	9.5	1.86	4.72	6.7	.91	01	
V0158		2.92	-9.7	.93	4.01	-9.5	.36	01	
V0161		3.00	-7.4	.40	4.20	-5.2	.45	01	
V0166		3.05	-5.9	1.21	4.10	-7.4	2.48X	01	
V0169		3.05	-5.9	1.21	3.95	-10.8	1.81	01	
V0178		3.60	11.1	.81	4.80	8.4	1.36	01	
V0182		3.05	-5.9	1.80	4.02	-9.1	1.40	01	
V0190		2.78	-14.2	3.55X	4.02	-9.1	.48	01	
V0207		3.50	8.0	1.10	4.85	9.5	1.36	01	
V0208		2.83	-12.5	.61	4.26	-3.8	3.22X	01	
V0211		3.15	-2.8	2.04	4.27	-3.5	.23	01	
V0213		3.00	-7.4	1.01	4.12	-6.9	1.96	01	
V0217		3.50	8.0	.00	4.90	10.6	.00	01	
V0220		3.10	-4.3	.40	4.30	-2.9	.00	01	
V0221		3.50	8.0	1.77	4.60	3.9	1.57	01	
V0238		3.50	8.0	.40	4.80	8.4	.23	01	
V0243		2.83	-12.7	1.31	4.14	-6.5	.64	01	
		3.24	- GR. MEAN -		4.43				3 TEST DETERMINATIONS
		.27	- SD MEANS -		.34				40 LABORATORIES IN GRAND MEANS
		.07	- AVER SDR -		.06				40 LABORATORIES REPORTING
		MINUTE	- UNIT -		MINUTE				


SCORCH TIME
MATERIAL Y81-Y82 3.24 MINUTE MATERIAL Y83-Y84 4.43 MINUTE
MATERIAL Y83-Y84
MATERIAL Y81-Y82
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
4.4
4.6

LAB CODE	F	MATERIAL Y81-Y82 COMMERCIAL TIRE TREAD MEAN MINUTE	% DEV	REL SDR	MATERIAL Y83-Y84 SBR MEAN MINUTE	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0071		7.40	1.1	.77	6.25	-1.5	.79	01	
V0074A		7.55	3.1	1.02	6.35	.1	.40	01	
V0074B		7.80	6.5	2.47X	6.99	10.2	1.76	01	
V0077		7.67	4.8	1.98	6.55	3.3	.20	01	
V0078		7.87	7.5	.97	6.81	7.4	1.98	01	
V0079		7.32	.0	.00	6.27	-1.1	.00	01	
V0083		8.20	12.0	1.06	7.15	12.7	1.45	01	
V0085		6.45	-11.9	.19	5.65	-10.9	.40	01	
V0086	X	8.10	10.6	.77	6.05	-4.6	1.45	01	
V0090		7.81	6.7	.97	6.66	5.1	.77	01	
V0092		7.07	-3.4	.97	5.85	-7.8	.54	01	
V0095		7.50	2.4	.00	6.60	4.1	.00	01	
V0100		7.60	3.8	1.55	6.45	1.7	1.48	01	
V0117		7.15	-2.4	1.78	6.20	-2.2	1.83	01	
V0120		6.65	-9.2	1.06	5.90	-7.0	1.59	01	
V0122		7.05	-3.7	.39	5.95	-6.2	1.59	01	
V0128		6.70	-8.5	.77	5.80	-8.5	1.84	01	
V0144		7.60	3.9	1.24	6.85	8.0	.40	01	
V0146		7.62	4.1	1.94	6.75	6.4	1.98	01	
V0149		7.22	-1.3	.53	6.42	1.3	.59	01	
V0150		7.00	-4.4	3.87X	6.00	-5.4	.00	01	
V0152		7.55	3.1	.39	6.60	4.1	.40	01	
V0154		7.05	-3.7	.39	6.10	-3.8	.20	01	
V0156		7.70	5.2	.58	6.72	6.0	.92	01	
V0158		6.62	-9.5	.72	5.75	-9.3	.72	01	
V0161		6.90	-5.8	1.06	6.00	-5.4	.40	01	
V0166		7.05	-3.7	1.16	5.90	-7.0	2.42X	01	
V0169		7.10	-3.0	1.45	5.90	-7.0	1.59	01	
V0178		8.10	10.6	1.06	6.95	9.6	1.48	01	
V0182		6.92	-5.4	1.55	5.75	-9.3	1.59	01	
V0190		7.67	4.8	1.41	6.63	4.5	.22	01	
V0207		8.40	14.7	1.41	7.05	11.2	.79	01	
V0208		7.09	-3.1	.73	6.29	-.8	.38	01	
V0211		7.12	-2.7	1.16	6.35	.1	.00	01	
V0213		6.77	-7.5	.39	6.12	-3.4	2.71X	01	
V0217		7.55	3.1	1.06	6.80	7.2	.79	01	
V0220		7.05	-3.7	1.06	6.05	-4.6	.40	01	
V0221		7.10	-3.0	4.90X	6.10	-3.8	1.84	01	
V0238		8.10	10.6	.39	7.00	10.4	.79	01	
V0243		6.43	-12.1	.84	5.80	-8.5	.92	01	
		7.32	- GR. MEAN -		6.34				3 TEST DETERMINATIONS
		.49	- SD MEANS -		.43				39 LABORATORIES IN GRAND MEANS
		.07	- AVER SDR -		.07				40 LABORATORIES REPORTING
		MINUTE	- UNIT -		MINUTE				


CURE TIME (50% MH)
MATERIAL Y81-Y82 7.32 MINUTE MATERIAL Y83-Y84 6.34 MINUTE
MATERIAL Y83-Y84
MATERIAL Y81-Y82
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5

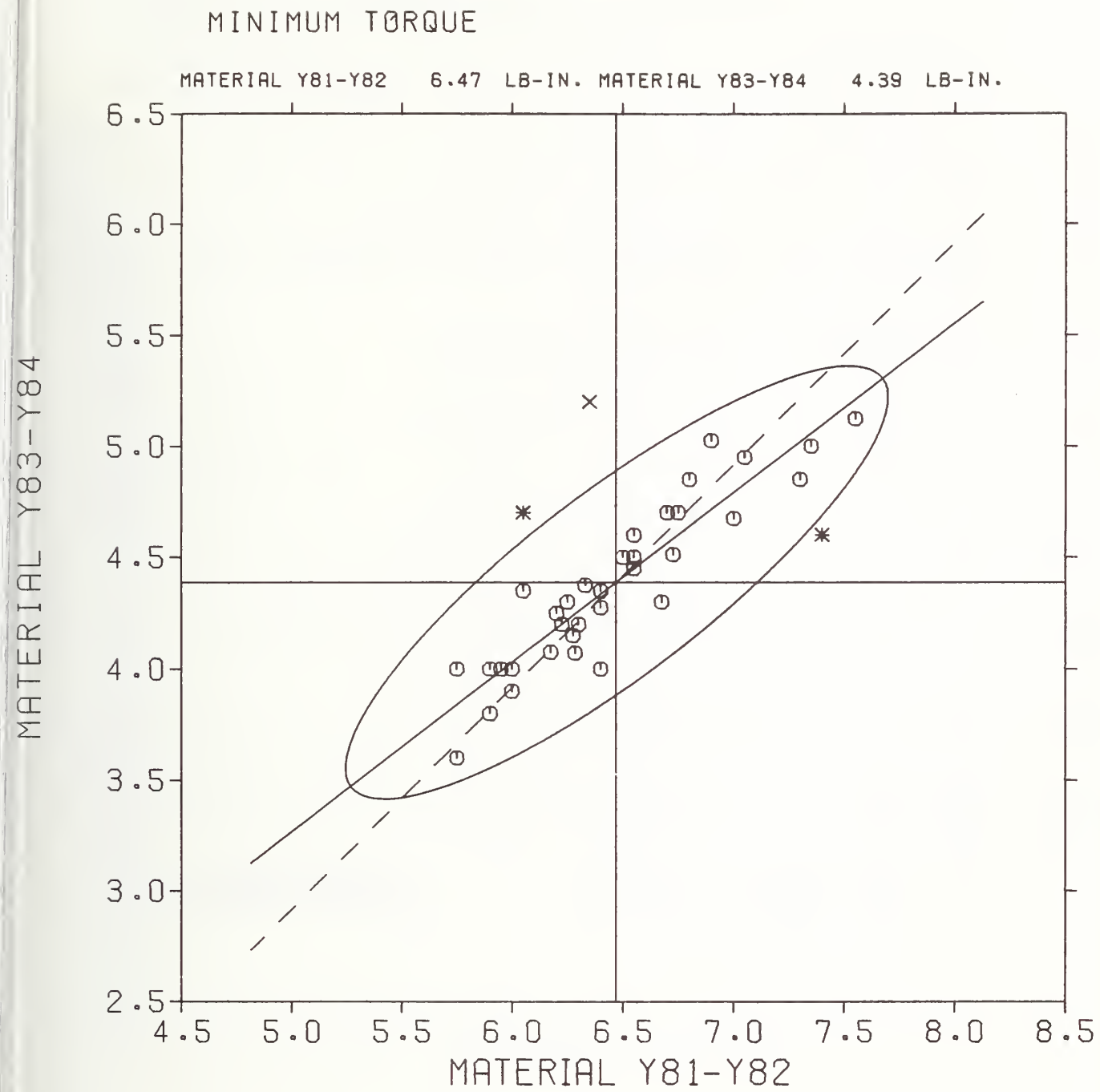
LAB CODE	F	MATERIAL Y81-Y82 COMMERCIAL TIRE TREAD MEAN MINUTE	% DEV	REL SDR	MATERIAL Y83-Y84 SBR MEAN MINUTE	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0071		15.45	1.8	1.14	9.35	-.2	.64	01	
V0074A		15.85	4.4	.60	9.55	1.9	.40	01	
V0074B		16.25	7.1	3.97X	10.38	10.8	2.22	01	
V0077		15.32	1.0	1.08	9.67	3.2	.35	01	
V0078		15.94	5.0	.97	10.12	8.0	2.11	01	
V0079	X	17.75	17.0	.00	9.50	1.4	.00	01	
V0083		16.50	8.7	4.69X	10.40	11.0	1.24	01	
V0085		13.25	-12.7	.81	8.32	-11.2	1.19	01	
V0086		15.80	4.1	.52	9.95	6.2	.00	01	
V0090		16.05	5.8	1.76	9.71	3.7	1.18	01	
V0092		14.85	-2.2	.52	8.60	-8.2	.40	01	
V0095		15.00	-1.2	.00	9.25	-1.3	.00	01	
V0100		15.25	.5	1.23	9.45	.8	.47	01	
V0117		14.55	-4.1	3.67X	9.30	-.8	1.69	01	
V0120		13.40	-11.7	4.51X	8.85	-5.6	7.04X	01	
V0122		15.95	5.1	.95	9.00	-4.0	1.04	01	
V0128		13.75	-9.4	1.30	8.50	-9.3	.47	01	
V0144		15.37	1.3	1.31	9.93	6.0	.06	01	
V0146		15.75	3.8	3.02X	10.12	8.0	2.77X	01	
V0149		15.45	1.8	.39	9.57	2.2	.70	01	
V0150		14.95	-1.5	2.28	8.87	-5.3	1.60	01	
V0152		15.35	1.1	.52	9.65	3.0	.47	01	
V0154		14.67	-3.3	.39	9.27	-1.0	.32	01	
V0156		15.70	3.4	1.18	9.75	4.0	1.12	01	
V0158		14.07	-7.3	1.17	8.40	-10.4	.66	01	
V0161		14.75	-2.8	1.16	8.95	-4.5	.64	01	
V0166		14.20	-6.4	.52	8.50	-9.3	1.24	01	
V0169		14.90	-1.8	1.04	8.75	-6.6	1.09	01	
V0178		16.75	10.4	.95	10.15	8.3	1.32	01	
V0182		14.22	-6.3	1.12	8.40	-10.4	1.23	01	
V0190		16.62	9.5	3.74X	9.98	6.5	.11	01	
V0207		16.55	9.0	.95	10.35	10.4	1.09	01	
V0208		14.07	-7.3	4.03X	9.29	-.8	1.97	01	
V0211		15.25	.5	.65	9.35	-.2	.23	01	
V0213		14.15	-6.8	1.82	8.87	-5.3	1.29	01	
V0217		15.05	-.8	1.39	9.90	5.6	.81	01	
V0220		15.80	4.1	2.58X	9.15	-2.4	1.72	01	
V0221		15.05	-.8	4.22X	8.65	-7.7	1.64	01	
V0238		16.50	8.7	.91	10.50	12.0	1.17	01	
V0243		13.54	-10.8	.39	8.71	-7.1	1.13	01	
		15.18	* GR. MEAN *		9.37				3 TEST DETERMINATIONS
		.93	* SD MEANS *		.64				39 LABORATORIES IN GRAND MEANS
		.11	* AVER SDR *		.12				40 LABORATORIES REPORTING
		MINUTE	* UNIT *		MINUTE				


CURE TIME (90% MH)
MATERIAL Y81-Y82 15.18 MINUTE MATERIAL Y83-Y84 9.37 MINUTE
MATERIAL Y83-Y84
MATERIAL Y81-Y82
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5

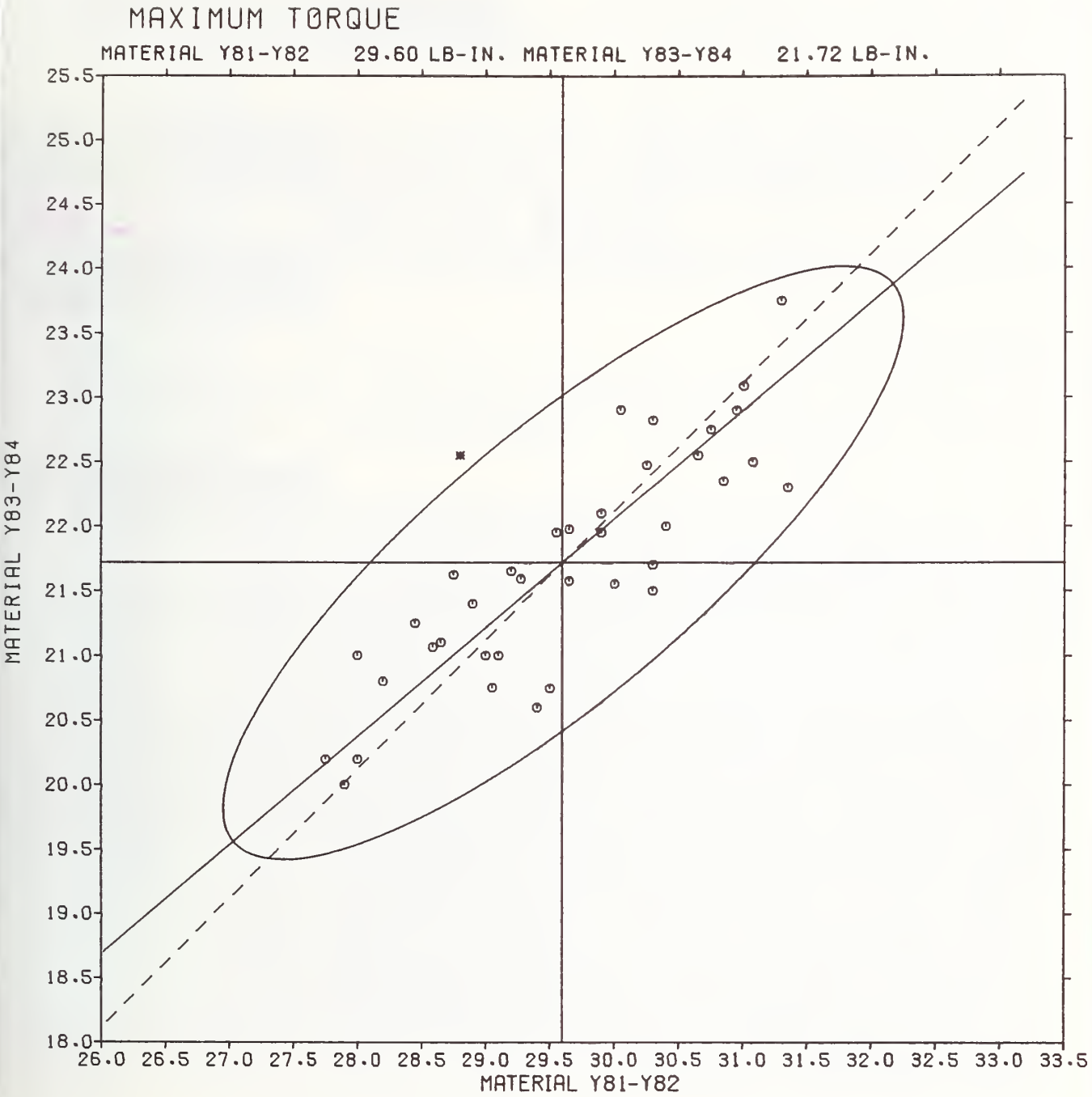
INTERLABORATORY PROGRAM ON EVALUATION OF RUBBER

REPORT 37 - 5 MINIMUM TORQUE - POUND-INCHES SEPTEMBER 1978

LAB CODE	F	MATERIAL Y81-Y82 COMMERCIAL TIRE TREAD MEAN LB-IN.	MEAN N-M	% DEV	REL SDR	MATERIAL Y83-Y84 SBR MEAN LB-IN.	MEAN N-M	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0071		6.22	.7034	-3.8	.99	4.20	.4746	-4.3	.85	01	
V0074A		6.90	.7796	6.6	.87	5.02	.5678	14.5	.78	01	
V0074B		6.27	.7090	-3.0	.54	4.15	.4689	-5.4	.80	01	
V0077		6.67	.7542	3.2	1.77	4.30	.4859	-2.0	.85	01	
V0078		7.05	.7966	9.0	1.08	4.95	.5593	12.8	2.13X	01	
V0079		5.75	.6497	-11.1	.00	3.60	.4068	-17.9	.00	01	
V0083		6.75	.7627	4.3	.79	4.70	.5311	7.1	.00	01	
V0085		6.73	.7600	4.0	.00	4.51	.5100	2.9	.00	40	ORIGINAL IN NEWTON-METER
V0086		6.25	.7062	-3.4	.40	4.30	.4859	-2.0	.85	01	
V0090		6.40	.7231	-1.1	2.14	4.27	.4830	-2.6	2.08X	01	
V0092		6.40	.7231	-1.1	.40	4.35	.4915	-.8	.85	01	
V0095		6.05	.6836	-6.5	.00	4.35	.4915	-.8	.00	01	
V0100		5.95	.6723	-8.0	1.19	4.00	.4520	-8.8	.00	01	
V0117		7.35	.8305	13.6	.68	5.00	.5649	14.0	.43	01	
V0120	*	6.05	.6836	-6.5	4.35X	4.70	.5311	7.1	4.20X	01	
V0122		7.30	.8248	12.8	1.19	4.85	.5480	10.6	1.59	01	
V0128	X	6.35	.7175	-1.9	.00	5.20	.5875	18.5	.85	01	
V0144		6.20	.7005	-4.2	.79	4.25	.4802	-3.1	1.59	01	
V0146		5.75	.6497	-11.1	3.95X	4.00	.4520	-8.8	.00	01	
V0149		6.17	.6977	-4.6	.40	4.07	.4604	-7.1	.43	01	
V0150		7.00	.7909	8.2	1.98	4.67	.5282	6.6	.64	01	
V0152		5.90	.6666	-8.8	.00	3.80	.4294	-13.4	.00	01	
V0154		6.80	.7683	5.1	.40	4.85	.5480	10.6	.85	01	
V0156		6.50	.7344	.5	.79	4.50	.5085	2.6	1.16	01	
V0158	*	7.40	.8361	14.4	3.52X	4.60	.5198	4.9	.98	01	
V0161		5.90	.6666	-8.8	1.19	4.00	.4520	-8.8	.43	01	
V0166		6.00	.6779	-7.3	.40	3.90	.4407	-11.1	.00	01	
V0169		6.28	.7100	-2.9	1.52	4.07	.4600	-7.2	3.05X	40	ORIGINAL IN NEWTON-METER
V0178		6.30	.7118	-2.6	.79	4.20	.4746	-4.3	1.28	01	
V0182		6.55	.7401	1.2	1.48	4.45	.5028	1.4	1.28	01	
V0190	X	13.90	1.5706	99.9	10.09X	9.35	1.0565	99.9	.85	01	
V0207		6.70	.7570	3.5	.00	4.70	.5311	7.1	1.16	01	
V0208		6.33	.7152	-2.2	.75	4.37	.4943	-.3	1.58	01	
V0211		6.40	.7231	-1.1	1.24	4.00	.4520	-8.8	.00	01	
V0213		7.55	.8531	16.7	.79	5.12	.5791	16.8	.00	01	
V0217		6.00	.6779	-7.3	.00	4.00	.4520	-8.8	.00	01	
V0220	X	7.90	.8926	22.1	1.08	6.05	.6836	37.9	.85	01	
V0221	X	3.55	.4011	-45.1	1.19	2.30	.2599	-47.6	1.75	01	
V0238		6.55	.7401	1.2	.40	4.50	.5085	2.6	1.07	01	
V0243		6.55	.7401	1.2	2.09	4.60	.5198	4.9	1.55	01	
		6.47	.7311	* GR. MEAN *		4.39	.4957				3 TEST DETERMINATIONS
		.47	.0534	* SD MEANS *		.37	.0423				36 LABORATORIES IN GRAND MEANS
		.07	.0083	* AVER SDR *		.07	.0077				40 LABORATORIES REPORTING
		LB-IN.	N-M	* UNIT *		LB-IN.	N-M				


MINIMUM TORQUE
MATERIAL Y81-Y82 6.47 LB-IN. MATERIAL Y83-Y84 4.39 LB-IN.
MATERIAL Y83-Y84
MATERIAL Y81-Y82
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5

LAB CODE	F	MATERIAL Y81-Y82 COMMERCIAL TIRE TREAD MEAN LB-IN.	MEAN N-M	% DEV	REL SDR	MATERIAL Y83-Y84 SBR MEAN LB-IN.	MEAN N-M	% DEV	REL SDR	VAR CODE	INSTRUMENT, UNIT, OR OTHER VARIATION
V0071		28.90	3.2654	-2.4	.28	21.40	2.4180	-1.5	.74	01	
V0074A		30.30	3.4236	2.4	1.71	22.82	2.5790	5.1	.55	01	
V0074B		29.27	3.3078	-1.1	1.08	21.59	2.4395	-.6	.95	01	
V0077		29.65	3.3502	.2	.80	21.97	2.4830	1.2	.40	01	
V0078		29.90	3.3784	1.0	.75	22.10	2.4971	1.8	1.08	01	
V0079		27.90	3.1524	-5.7	.00	20.00	2.2598	-7.9	.00	01	
V0083		30.75	3.4744	3.9	3.64X	22.75	2.5705	4.8	4.53X	01	
V0085		30.00	3.3901	1.4	.50	21.55	2.4351	-.8	.24	40	ORIGINAL IN NEWTON-METER
V0086		28.20	3.1863	-4.7	1.14	20.80	2.3502	-4.2	.54	01	
V0090		28.45	3.2146	-3.9	1.14	21.25	2.4010	-2.1	1.47	01	
V0092		31.30	3.5366	5.8	.78	23.75	2.6835	9.4	.54	01	
V0095		27.75	3.1355	-6.2	.00	20.20	2.2824	-7.0	.00	01	
V0100		30.30	3.4236	2.4	2.73X	21.50	2.4293	-1.0	1.08	01	
V0117		30.40	3.4349	2.7	8.88X	22.00	2.4858	1.3	.54	01	
V0120	*	28.80	3.2541	-2.7	5.46X	22.55	2.5479	3.8	3.78X	01	
V0122		30.65	3.4631	3.6	1.06	22.55	2.5479	3.8	2.16	01	
V0128		29.05	3.2824	-1.8	.75	20.75	2.3445	-4.4	.98	01	
V0144		29.55	3.3389	-.2	1.35	21.95	2.4801	1.1	.54	01	
V0146		28.00	3.1637	-5.4	2.84X	21.00	2.3728	-3.3	.00	01	
V0149		29.65	3.3502	.2	.39	21.57	2.4378	-.7	.37	01	
V0150		29.50	3.3332	-.3	4.93X	20.75	2.3445	-4.4	2.85X	01	
V0152		29.10	3.2880	-1.7	.28	21.00	2.3728	-3.3	.00	01	
V0154		30.05	3.3953	1.5	.78	22.90	2.5875	5.5	1.08	01	
V0156		29.20	3.2993	-1.3	.85	21.65	2.4462	-.3	1.89	01	
V0158		31.35	3.5422	5.9	2.41	22.30	2.5197	2.7	.74	01	
V0161		28.00	3.1637	-5.4	.28	20.20	2.2824	-7.0	1.43	01	
V0166		29.40	3.3219	-.7	.28	20.60	2.3276	-5.1	1.35	01	
V0169		28.59	3.2301	-3.4	.87	21.06	2.3801	-3.0	1.13	40	ORIGINAL IN NEWTON-METER
V0178		28.65	3.2372	-3.2	.00	21.10	2.3841	-2.8	.98	01	
V0182		30.85	3.4857	4.2	.99	22.35	2.5253	2.9	.81	01	
V0190	X	64.50	7.2875	99.9	21.97X	45.75	5.1693	99.9	.27	01	
V0207		30.95	3.4970	4.6	.78	22.90	2.5875	5.5	1.08	01	
V0208		31.00	3.5033	4.8	2.29	23.09	2.6089	6.3	3.78X	01	
V0211		31.07	3.5112	5.0	2.23	22.50	2.5423	3.6	.27	01	
V0213		30.25	3.4179	2.2	3.88X	22.47	2.5395	3.5	1.18	01	
V0217		29.00	3.2767	-2.0	.00	21.00	2.3728	-3.3	.00	01	
V0220		30.30	3.4236	2.4	1.52	21.70	2.4519	-.1	1.79	01	
V0221	X	15.60	1.7626	-47.3	3.86X	11.35	1.2824	-47.7	.71	01	
V0238		28.75	3.2485	-2.9	.71	21.62	2.4434	-.4	.94	01	
V0243		29.90	3.3784	1.0	3.41X	21.95	2.4801	1.1	2.16	01	
		29.60	3.3442	* GR. MEAN *		21.72	2.4537				3 TEST DETERMINATIONS
		1.02	.1156	* SD MEANS *		.89	.1003				38 LABORATORIES IN GRAND MEANS
		.10	.0115	* AVER SDR *		.11	.0121				40 LABORATORIES REPORTING
		LB-IN.	N-M	* UNIT *		LB-IN.	N-M				


MAXIMUM TORQUE
MATERIAL Y81-Y82 29.60 LB-IN. MATERIAL Y83-Y84 21.72 LB-IN.
MATERIAL Y83-Y84
25.5
25.0
24.5
24.0
23.5
23.0
22.5
22.0
21.5
21.0
20.5
20.0
19.5
19.0
18.5
18.0
26.0 26.5 27.0 27.5 28.0 28.5 29.0 29.5 30.0 30.5 31.0 31.5 32.0 32.5 33.0 33.5
MATERIAL Y81-Y82

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15. SUPPLEMENTARY NOTES

☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

Collaborative Reference Programs provide participating laboratories with the means for checking periodically the level and uniformity of their testing in comparison with that of other participating laboratories. An important by-product of the programs is the provision of realistic pictures of the state of the testing art. This is one of the periodic reports showing averages for each participant, within and between laboratory variability, and other information for participants and standards committees.

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*

Collaborative reference program; Laboratory evaluation; Precision; Reference samples; Rubber; Testing calibration.

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